

Mark Scheme (Results)

GCE

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

GENERAL INFORMATION

The following symbols are used in the mark schemes for all questions:

Symbol	Meaning of symbol
; semi colon	Indicates the end of a marking point
eq	Indicates that credit should be given for other correct alternatives to a word or statement, as discussed in the Standardisation meeting
/ oblique	Words or phrases separated by an oblique are alternatives to each other
{ } curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion
() round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point
[] square brackets	Words inside square brackets are instructions or guidance for examiners
[CE] or [TE]	Consecutive error / transferred error

Crossed out work

If a candidate has crossed out an answer and written new text, the crossed out work can be ignored. If the candidate has crossed out work but written no new text, the crossed out work for that question or part question should be marked, as far as it is possible to do so.

Spelling and clarity

In general, an error made in an early part of a question is penalised when it occurs but not subsequently. The candidate is penalised once only and can gain credit in later parts of the question by correct reasoning from the earlier incorrect answer.

No marks are awarded specifically for quality of language in the written papers, except for the essays in the synoptic paper. Use of English is however taken into account as follows:

- the spelling of technical terms must be sufficiently correct for the answer to be unambiguous
e.g. for amylase, 'ammalase' is acceptable whereas 'amylose' is not
e.g. for glycogen, 'glicojen' is acceptable whereas 'glucagen' is not
e.g. for ileum, 'illeum' is acceptable whereas 'ilium' is not
e.g. for mitosis, 'mytosis' is acceptable whereas 'meitosis' is not
- candidates must make their meaning clear to the examiner to gain the mark.
- a correct statement that is contradicted by an incorrect statement in the same part of an answer gains no mark - irrelevant material should be ignored

Question Number	Answer	Mark
1(a)	cross next to degree of muscle concentration ; cross next to signs of decomposition ;	(2)

Question Number	Answer	Mark
1(b)	<ol style="list-style-type: none"> 1. idea of SD {measures / shows} {spread / range / eq} of data ; 2. Idea of most readings are within $\{\pm 1 \times \text{SD} / \pm 2 \times \text{SD}\}$ e.g. approx 60% readings within $(\pm) 1 \times \text{SD}$ / approx 90% readings within $(\pm) 2 \times \text{SD}$; 3. idea that as length of time increases, SD increase / eq ; 4. idea of more variability (in temperature) as time increases / eq ; 5. comment on change in reliability of time of death with time / eq ; 6. estimate (of time of death) can only be within a {4 / 5 / 6 / 7} hour period ; 7. use of manipulated data ; 	max (4)

Question Number	Answer	Mark
1(c)	<p>three from the following:</p> <p>{(body) mass/ BMI / weight / eq} {(subcutaneous) fat /eq} surface area, {ambient / eq } temperature immersion in water age (of person at death) skin colour thickness of hair gender clothing blood loss humidity air movement {core / body} temperature at time of death ;;;</p>	(3)

Question Number	Answer	Mark
2(a)	<ol style="list-style-type: none"> 1. idea of reflection ; 2. reference. to {incorrect / eq } {wavelength / colour / frequency} ; 3. idea of {not hitting the {chloroplast / chlorophyll}} / it is transmitted ; 4. idea of light being in excess e.g. at max. photosynthesis so more light can be used ; 	max (2)

Question Number	Answer	Mark
2(b)(i)	{joules / energy} per {square metre / metre squared / (unit) area} per {year / unit time} ;	(1)

Question Number	Answer	Mark
2(b)(ii)	<p>Award 2 marks for correct answer (84.8 / 84.84)</p> <ol style="list-style-type: none"> 1. correct subtraction (24.4 - 3.7 / 20.7) ; 2. correct multiplication by 100 ÷ 24.4 ; <p>[consequential errors apply]</p>	(2)

Question Number	Answer	Mark
2(b)(iii)	B ;	(1)

Question Number	Answer	Mark
2(c) [QWC]	<p>(QWC - Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. reference to {<i>thylakoids / thylakoid</i> (membranes)} ; 2. in {<i>granum / grana</i>} ; 3. (light energy) raises energy level of <i>electrons</i> / {<i>chlorophyll / electrons</i>}excited / eq ; 4. <i>electrons</i> released from {<i>chlorophyll</i> /photosystem / eq} / eq ; 5. reference to <i>electron</i> {carrier / eq} ; 6. reference to series of {redox / oxidation & reduction / eq} reactions ; 7. reference to energy level of <i>electrons</i> {falls / eq} ; 8. reference to {synthesise ATP from ADP +P / phosphorylate ADP} ; 9. reference to <i>photophosphorylation</i> ; 10. reference to ATP {<i>synthetase / synthase / ase</i>} ; 11. reference to {<i>chemiosmosis</i> / eq} ; 12. idea of <i>electrons</i> from {<i>photolysis</i> / eq} used to replace those lost ; 13. reference to involvement of {accessory pigments / named example} ; 	<p>max (6)</p>

Question Number	Answer	Mark
3(a)(i)	C ;	(1)

Question Number	Answer	Mark
3(a)(ii)	C ;	(1)

Question Number	Answer	Mark
3(b)(i)	temperature ;	(1)

Question Number	Answer	Mark
3(b)(ii)	<ol style="list-style-type: none"> 1. rate of growth increases as temperature increases {between 13°C and 22°C / up to 22°C} ; 2. rate of growth decreases {between 22°C and 25°C / above 22°C} ; 3. use of manipulated data to support above e.g. increases by {0.7 (a.u.) / 4.5 times}, decreases by 0.1 (a.u.) ; 4. reference to enzymes involved (in growth) ; 5. molecules {move about more / have more kinetic energy}, as temperature increases ; 6. (therefore) {enzyme and substrate (molecules) collide more / rate of enzyme-substrate complexes formation increases} as temperature increases ; 7. correct reference to denaturation of some {enzyme / protein / eq} (molecules) ; 8. (therefore) rate of {growth / reactions} decreases as fewer enzyme molecules available ; 	max (4)

Question Number	Answer	Mark
3(b)(iii)	<ol style="list-style-type: none"> 1. idea that (each temperature) has same light intensity ; 2. correct reference to must be above {threshold / compensation point} ; 3. (below which) no net photosynthesis takes place / eq ; 4. reference to {so light is not limiting factor / so temperature is the limiting factor}; 5. photosynthesis produces {material / eq} needed for growth / eq ; 	max (3)

Question Number	Answer	Mark
3(b)(iv)	<ol style="list-style-type: none"> 1. {wavelength / colour / frequency} of light ; 2. CO₂ concentration / eq ; 3. pH / eq (of solution) ; 4. reference to {mineral / eq} ; 	max (2)

Question Number	Answer	Mark
4(a)(i)	C ;	(1)

Question Number	Answer	Mark
4(a)(ii)	A ;	(1)

Question Number	Answer	Mark
4(b)(i)	<p>D = antigens / (glyco)proteins ;</p> <p>E = B {lymphocytes / cells} / plasma cells ;</p> <p>F = antibodies / immunoglobulins ;</p> <p>G = macrophage / phagocyte / eq ;</p> <p>H = enzymes / lysozyme ;</p>	(5)

Question Number	Answer	Mark
4(b)(ii)	<ol style="list-style-type: none"> 1. reference to protein nature of {antigens / antibodies} ; 2. antigens are specific (to each bacteria) / eq ; 3. antibodies need to be {complementary / specific} (to the antigen) ; 4. idea that {binding / eq} can take place ; 5. (some bacteria) have {different / changed} antigens / eq ; 6. idea that this is a primary infection ; 7. reference to {mucus / slime} {coat /capsule} (of bacterial cells) ; 8. idea that some bacteria are inside body cells ; 9. idea of antibodies already present e.g. from passive immunity or breast feeding ; 	<p style="text-align: right;">max (3)</p>

Question Number	Answer	Mark																				
5(a)	<table border="1"> <thead> <tr> <th>Description</th> <th>DNA only</th> <th>RNA only</th> <th>Both DNA and RNA</th> </tr> </thead> <tbody> <tr> <td>Polymer formed from a single strand of nucleotides</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>Pentose present in the nucleotides</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>Adenine, cytosine, guanine and thymine present</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>Nucleotides linked by phosphodiester bonds</td> <td></td> <td></td> <td>✓</td> </tr> </tbody> </table> <p>all rows correct 2 marks two or three rows correct 1 mark</p>	Description	DNA only	RNA only	Both DNA and RNA	Polymer formed from a single strand of nucleotides		✓		Pentose present in the nucleotides			✓	Adenine, cytosine, guanine and thymine present	✓			Nucleotides linked by phosphodiester bonds			✓	(2)
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Question Number	Answer	Mark
5(b)(i)	<ol style="list-style-type: none"> 1. DNA strands {separate / unzip / eq} ; 2. idea that one DNA {strand / eq} used as template (to form mRNA) / eq ; 3. from free nucleotides / eq ; 4. reference to complementary base pairing ; 5. reference to hydrogen bonding ; 6. correct reference to {RNA-polymerase / DNA helicase} ; 7. credit correct sequence of bases on {mRNA / DNA} ; 	max (3)

Question Number	Answer	Mark
5(b)(ii)	<ol style="list-style-type: none"> 1. reference to specific amino acid attachment to tRNA ; 2. idea that anticodon (on tRNA) {attaches / binds / lines up / eq} to the {codon / triplet} on mRNA ; 3. example quoted using the information in the diagram e.g. tRNA with alanine has CGA anticodon which binds to GCU on mRNA ; 4. idea that two tRNA held in ribosome (at any one time) ; 5. reference to formation of peptide {bonds / links} (between adjacent amino acids) ; 6. reference to peptidyl transferase ; 	max (3)

Question Number	Answer	Mark
5(c)	<ol style="list-style-type: none"> 1. <u>stop codon</u> ; 2. used to end the {sequencing / further attachment of tRNA / eq} ; 3. release of the {polypeptide / ribosome} /eq ; 	max (2)

Question Number	Answer	Mark
6(a)	<ol style="list-style-type: none"> 1. idea that individuals of a species can {interbreed / eq} ; 2. to produce fertile {offspring / eq} ; 3. the {hybrids / offspring} can flower and produce viable seeds / eq ; 	max (3)

Question Number	Answer	Mark
6(b)(i)	<ol style="list-style-type: none"> 1. {variety / eq} of alleles ; 2. in a gene pool / eq ; 	(2)

Question Number	Answer	Mark
6(b)(ii)	<ol style="list-style-type: none"> 1. different alleles in each of the two {populations / eq} ; 2. each {population / species} is adapted to live {in different environmental conditions / at different altitudes / eq} ; 3. there will have been different mutations in each population ; 4. reference to alleles from different {species / eq } will mix / hybrids receive alleles from both { species / eq} ; 	max (2)

Question Number	Answer	Mark
*6(c) QWC	<p>(QWC - Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. reference to original population increasing in size and spreading into a wider diversity of {habitats / eq} ; 2. reference to mutations ; 3. leading to diversity in flowering times / eq ; 4. (and) other plant features / eq ; 5. reference to reproductive isolation ; 6. restriction in gene flow / eq ; 7. between extremes of population / eq ; 8. reference to different environmental factors in each region ; 9. each region has different selection pressures / eq ; 10. idea of plants adapted to a region ; 11. reference to survival and breeding ; 12. reference to change in allele frequencies (over time) ; 13. (leads to) differences between gene pools / eq ; 	<p>max (6)</p>

Question Number	Answer	Mark
7(a)	<ol style="list-style-type: none"> 1. reference to {carbon / organic / eq} compounds in plant material ; 2. idea that digestion provides respiratory substrates ; 3. carbon dioxide released (from respiration) ; 4. (this carbon dioxide is) available for photosynthesis ; 5. reference to woodlice {eaten / decompose} ; 	max (3)

Question Number	Answer	Mark
7(b)(i)	A ;	(1)

Question Number	Answer	Mark
7(b)(ii)	<ol style="list-style-type: none"> 1. {wavelength / colour / frequency} of light ; 2. light intensity / shading ; 3. temperature ; 4. moisture content of {air / substratum / eq} / humidity ; 5. {pH / chemical composition / eq} of {substratum / eq} ; 6. air currents / wind / eq ; 7. texture of substratum / eq ; 8. reference to {oxygen / carbon / methane} ; 	max (2)

Question Number	Answer	Mark						
7(c)(i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td style="text-align: center;">8</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;">9</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">10</td> <td style="text-align: center;">1</td> </tr> </tbody> </table> <p>All three answers correct to 1 significant figure ;</p>	8	3	9	1	10	1	(1)
8	3							
9	1							
10	1							

Question Number	Answer	Mark
7(c)(ii)	<ol style="list-style-type: none"> 1. woodlice move about / eq ; 2. (therefore) difficult to count / eq ; 3. some might be {counted more than once / missed out} / eq ; 	max (2)

Question Number	Answer	Mark
7(c)(iii)	<ol style="list-style-type: none"> 1. for results to be (scientifically) valid ; 2. only one factor needs to be varied / eq ; 3. other factors need to be kept constant / eq ; 4. reference to {many / biotic / eq} factors (in a garden) ; 5. (these factors are) {difficult to control / eq} ; 6. reference to difficult to set test factor values ; 	max (3)

Question Number	Answer	Mark												
8(a)	<table border="1"> <thead> <tr> <th>Description</th> <th>Name of structure</th> <th>P, E or B</th> </tr> </thead> <tbody> <tr> <td>Enclosed by outer smooth membrane inner membrane folded forming cristae</td> <td>Mitochondrion / mitochondria</td> <td>E / eukaryotic</td> </tr> <tr> <td>Long strand-like structure extending out from the cell Used for locomotion</td> <td>Flagellum / flagella</td> <td>B / both</td> </tr> <tr> <td>Small, circular loop of double-stranded DNA</td> <td>plasmid</td> <td>P / prokaryotic</td> </tr> </tbody> </table>	Description	Name of structure	P, E or B	Enclosed by outer smooth membrane inner membrane folded forming cristae	Mitochondrion / mitochondria	E / eukaryotic	Long strand-like structure extending out from the cell Used for locomotion	Flagellum / flagella	B / both	Small, circular loop of double-stranded DNA	plasmid	P / prokaryotic	(3)
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Small, circular loop of double-stranded DNA	plasmid	P / prokaryotic												
1 mark for any two correct cells ;;;														

Question Number	Answer	Mark
8(b)(i)	bactericidal ;	(1)

Question Number	Answer	Mark
8(b)(ii)	<ol style="list-style-type: none"> 1. cell wall {weaker /cannot form properly / eq} ; 2. {cell / cell wall} bursts (easily) / eq ; 3. during division /eq ; 	max (2)

Question Number	Answer	Mark
8(b)(iii)	<ol style="list-style-type: none"> 1. reference to antibiotic acting as selective pressure ; 2. reference to some bacteria resistant (to antibiotic) ; 3. idea that resistant bacteria survive and {reproduce / pass on resistance / pass on gene / eq}; 4. idea that antibiotic no longer effective ; 5. reference to some infections cannot be treated with antibiotics ; 	<p>max (2)</p>

Question Number	Answer	Mark
8(c)	<ol style="list-style-type: none"> 1. idea of bacteria distributed evenly / description of technique e.g. lawn spreading ; 2. description of method used to apply different antibiotics at known positions e.g. multidisks, wells in agar ; 3. reference to control of antibiotic concentration ; 4. reference to {sterile / aseptic} technique ; 5. reference to incubation at a suitable temperature ; 6. description of how effect is assessed e.g. measure {clear area / inhibition zone / eq} ; 7. reference to replication (with same bacterium) ; 8. reference to repetition with different bacteria ; 	<p style="text-align: right;">max (4)</p>

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